WHAT IS CLAIMED IS:

1. A high code rate low error probability underwater acoustic coherent communication system, including a host machine installed on a mother ship or main control underwater vehicle A and a guest machine installed on a second ship or a second underwater vehicle B, wherein the host machine comprises a transmitting transducer, a receiving line array and an electric subassembly, the transmitting transducer and the receiving line array are lowered down into water from the mother ship or the main control underwater vehicle A and electrically connected to a transmitter and a multi-channel receiver of the electric subassembly of the host machine respectively; The guest machine comprises a transmitting/receiving transducer and an electric subassembly, the transmitting/receiving transducer is lowered down into water from the second ship or installed in the second underwater vehicle B and electrically connected to a transmitter and a receiver of the electric subassembly of the guest machine respectively. What is characterized is that the center frequency of the communication system is ranged from 7 kHz to 45 kHz, the bandwidth is ranged from 5 kHz to 20 kHz, the receiving line array of the host machine consists of 2 to 16 hydrophones and vertically deployed underwater with space from 8 to 40 wave lengths between adjacent hydrophones, each hydrophone being non-directive in the horizontal, and the receiving sensitivity frequency response satisfy the predetermined bandwidth of the system.

2. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 1, wherein said transmitting transducer of the host machine or the transmitting/receiving transducer of the guest machine may be a horizontal non-directive transducer or directive transducer with beam angle ranged from 60° to 120°.

3. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 1, wherein said electric subassembly of the host machine comprises a transmitter, a multi-channel receiver, a multi-channel data sampler, a high speed digital signal processor, an input/output interface and a main control computer, wherein the receiver is electrically connected to the multi-channel data sampler, the multi-channel data sampler is electrically connected to high speed digital signal processor, which is electrically connected to a main control computer, and

the input/output interface is electrically connected to the main control computer, the transmitter and the multi-channel receiver.

4. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 1, wherein said electric subassembly of the guest machine comprises a transmitter, an single channel receiver, a data sampler, a high speed digital signal processor, an input/output interface and a main control computer, wherein the transmitting/receiving transducer is electrically connected with the receiver and the transmitter, the receiver is electrically connected to the data sampler, the data sampler is electrically connected to the high speed digital signal processor, high speed digital signal processor is electrically connected to the main control computer, input/output interface is electrically connected with the transmitter, the single channel receiver, and the main control computer.

5. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 4, wherein said guest machine further comprises a wakeup circuit, which is a low power consumption circuit with the power consumption lower than 10mW. Its input links to the transmitting/receiving transducer and its output links to main control computer.

6. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 1 or 5, wherein the center frequency of the transmitter is ranged from 7 to 45 kHz, the bandwidth is ranged from 5 kHz to 20 kHz, the output power of the transmitter should be higher than 5W.

7. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 1, wherein said multi-channel receiver of the host machine consists of 2 to 16 channel receiver, each channel is connected to one hydrophone, the center frequency of each channel is ranged from 7 kHz to 45 kHz, the bandwidth is ranged from 5 kHz to 20 kHz, each channel has a gain no less than 40 dB, and has an automatic gain control circuit and a band pass filter for filtering noise and interference.

8. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 4, wherein said data sampler of the host machine have channels number not less than the receiver, and sampling speed for each

channel is equal to or more than 4 times of the output signal bandwidth of the receiver, the bit number of the AD converter is no less than 10 bits.

9. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 4, wherein the processing capacity of said high speed digital signal processor of the host machine is not lower than 400 MIPS, the RAM is not lower than 256k bytes, the data throughput between the digital signal processor and the multi-channel data sampler is not lower than the data output rate of the multi-channel data sampler.

10. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 3, wherein said receiver of the guest machine is a single channel receiver electrically connected with the transmitting/receiving transducer.

11. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 4, wherein the sampling rate of the data sampler of the guest machine is not lower than 4 times of the bandwidth of the receiver, and the bit number of the A/D converter is not lower than 10 bits.

12. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 4, wherein the processing capacity of said high speed digital signal processor of the guest machine is not lower than 33 MIPS, the RAM is not lower than 128k bytes, the data throughput between the digital signal processor and the data sampler is not lower than the data output rate of the data sampler.

13. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 3, wherein said receiver of the host machine may have quadrature mixing circuits and outputs quadrature base band signal, or directly output without mixing.

14. The high code rate low error probability underwater acoustic coherent communication system as claimed in claim 3 or 4, wherein said input/output interface of the host and guest machines include at least one DA output, of which the resolution is not lower than 10 bits, and the refresh speed is not less than 30k SPS.

15. A method for processing underwater acoustic coherent signal by using the high code rate low error probability underwater acoustic coherent communication system as

claimed in claim 1, which is characterized that it includes steps of: (1) signal transmitting step; (2) signal receiving step; and (3) processing step for the received signal. The signal transmitting step includes first modulating the source data, sending the modulated data to the transmitter via the input/output interface, and driving the transmitting transducer or the transmitting/receiving transducer to emit acoustic signal. The receiving step of the host machine includes converting the acoustic signal propagating to the hydrophones of the receiving line array of the host machine into electrical signal, condition them in the multi-channel receiver, and digitizing them in the multi-channel data sampler. The receiving step of the guest machine includes converting the acoustic signal propagating to the transmitting/receiving transducer of the guest machine into electrical signal, conditioning the signal in the receiver, and digitizing it in the data sampler. The processing of the received signal includes: processing the digitalized signal in the high speed digital signal processor, saving the processing result in a hard disk, or send the result to other terminals via serial ports. What is characterized is that the modulating method is the multiple phase shift keying modulation, the host machine utilizes a multi-hydrophone receiving line array, a multi-channel receiver and multi-channel data sampler to realize space diversity, the processing step including processing signal based on the joint algorithm of space diversity, self-optimized multi-channel adaptive decision feedback equalizer and self-optimized adaptive phase tracker, wherein the self-optimized multi-channel adaptive decision feedback equalizer utilizes the fast optimization least mean square algorithm of, the gain factor μ of which is adjusted based on the algorithm of least mean square, the self-optimized adaptive phase tracker provides phase compensation to multi-channel signals based on the fast self-optimized least mean square algorithm, the gain factor γ of which is adjusted based on the algorithm of least mean square.